

Remarks

Claims 22 and 26 have been further amended. Claim 22 has been amended to require the presence of a polyether polyol or a polyester polyol together with the urethane diol. Claim 22 has also been amended to recite that the composition, when exposed to moisture, will cure to an irreversible solid form. Claim 26 has been amended for clarity. New claims 35, 36 and 37 have been added. Support may be found in the claims as originally filed, on page 2, lines 16-17, page 3, lines 1-2 and 13-18, page 11, lines 11-12, and in the Examples. No new matter has been added. Entry is requested.

The claims have been rejected under 35 U.S.C. § 112, first paragraph. It is the examiner's position that the claims contain subject matter that was not described in the originally filed disclosure.

Applicants disagree. While additional support for the recitation of "polyurethane prepolymers" may be found, e.g., on page 11, line 13, in order to decrease the number of issues to be argued, the claims have been amended to overcome this rejection.

All claims have been rejected under 35 U.S.C. § 103 (a) as being unpatentable over Chu (U.S. Patent No. 6,482,878) in combination with Younes (U.S. Patent No. 4,757,123) and Coury et al. (U.S. Patent No. 5,001,210).

Coury discloses polyurethane formulations that are particularly well suited for use in biomedical applications, but are not moisture curable. The polyurethanes of Coury are prepared by reacting a di-poly (hydroxylalkyl urethane) - formed by reacting a polyamine and a cyclic carbonate - with a polyisocyanate. Coury fails to disclose a composition that contains an excess of isocyanate groups required for reaction with moisture and is silent as to the moisture curability of the described compositions. There is a 1/1 stoichiometry between the urethane polyol and polyisocyanate in all examples of Coury. The polyurethanes of Coury are not moisture curable to an irreversible solid form, as would be recognized by the skilled artisan.

Younes describes the preparation of rigid cast or transfer molded polyisocyanate composition. The composition is prepared by reacting a di- or polyisocyanate, a cyclic alkylene carbonate and a soluble tertiary amine, and a cyclic alkylene carbonate as a catalyst.

Chu is cited as disclosing the claimed moisture curing hot melt adhesive except for the use of the claimed urethane diol to make polyurethane prepolymer. It is the examiner's position that it would have been obvious to use the urethane diols as the low molecular diols of Chu

because they would have been expected to give the properties disclosed by Coury and Younes, including the catalytic activity described by Younes, which catalytic activity would have been expected to give improved curing since it would have been expected to catalyze the water/NCO reaction.

Applicants disagree.

The claimed invention is directed to moisture-curing urethane adhesives, generally referred to in the art as moisture curable hot melt adhesives. In the practice of applicants' invention, a mixture of polyether and/or polyester polyols and urethane diols are reacted with an excess of polyisocyanate to prepare a moisture curable hot melt adhesive. The urethane diol used in the practice of the claimed invention is obtained by reacting a cyclic carbonate and an amino containing compound. The composition of the invention is a moisture curable reactive hot melt adhesive and, as such, reacts in the presence of moisture to form a crosslinked moisture cured adhesive.

Being a moisture curable hot melt, a stoichiometric imbalance of NCO to OH groups is required in order for moisture cure to proceed. As discussed in applicants' disclosure, and as argued in applicants' prior response, moisture-curing hot melt adhesives consist primarily of isocyanate-capped polyurethane prepolymers obtained by reacting diols (selected from polyethers, polyesters and polybutadienes) with a polyisocyanate (most commonly methylene bisphenyl diisocyanate (MDI)). The mole ratio of NCO/OH is high, typically 1.5-2.0. Cure is obtained through the diffusion of moisture from the atmosphere or the substrates into the adhesive and subsequent reaction. The reaction of moisture with residual isocyanate forms carbamic acid. This acid is unstable, decomposing into an amine and carbon dioxide. The amine reacts rapidly with isocyanate to form a urea. The final adhesive product is a lightly crosslinked material held together primarily through hydrogen bonding of urea groups, and to a lesser extent by the urethane groups. That excess isocyanate is required in order to be moisture curable is well recognized in the art. See, e.g., Handbook of Adhesives, Third Edition, 1990, Irving Skeist, Editor., pp. 8-9 and U.S. Patent No. 7,022,804.

As previously argued in applicants response filed November 13, 2006, if the architecture of the backbone is incorrect, the materials become unstable and premature crosslinking occurs upon heating, i.e., when heated for purposes of application. This premature crosslinking result is caused by the formation of allophanate from the reaction between the terminal isocyanate groups

and the in-chain urethane groups. Polymers with multiple urethane groups in the backbone and –NCO end-groups, e.g. prepared by –NCO/-OH ratios between 1.0-1.5 are thermally unstable. On this basis, the use of low molecular weight urethane diols in a polyol mixture would be expected to provide a substantial increase in the urethane groups in the backbone and therefore would also be expected to provide issues with premature crosslinking even with –NCO/OH ratios in the range 1.5-2.0.

There is no disclosure in Coury or in Younes of the use of urethane diols to make moisture curable reactive hot melt adhesives. The diols used by Chu do not contain urethane groups. There is no disclosure or suggestion that incorporating urethane diols into the reaction mixture of Chu would not cause premature crosslinking or other associated problems. Moreover, there is nothing in either of the applied Coury and Younes secondary reference when combined with the Chu primary reference that would suggest using a urethane diol to prepare a moisture curing hot melt, or that such a hot melt would show improvements in open time or green strength with low melt viscosity as discovered by applicants.

Applicants submit that the examiner's rejection is based on the impermissible use of hindsight. Only with knowledge of applicants' disclosure could the examiner argue that the urethane diol suggested in the Coury and Younes disclosures could be added as a component of the Chu moisture curing hot melt. The suggestion to use a urethane diol of the type that would result by reacting a cyclic carbonate and an amino group containing compound in a moisture curing hot melt adhesive would not be obvious to the skilled artisan and is not suggested by Chu in combination with the disclosures of the Younes and Coury patent references.

Withdrawal of this Section 103 rejection is requested.

Favorable and early action is requested.

Respectfully submitted,

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